

What is claimed is:

1. An apparatus for detecting an error signal which indicates defocus and/or a change in thickness of a recording medium, the apparatus comprising:

a photodetector having first, second and third light receiving regions arranged in a radial direction of a recording medium, to independently perform photoelectric conversion with respect to incident light which is reflected/diffracted by the recording medium and to generate first, second and third detection signals, respectively; and

a subtractor which subtracts a sum of the first and third detection signals and the second detection signal and outputs the error signal.

2. The apparatus as claimed in claim 1, wherein:

one of the three light receiving regions is divided in the radial direction of the recording medium and each of the three light receiving regions is divided in a tangential direction of the recording medium to form eight light receiving regions; and

the eight light receiving regions are used to detect information signals recorded on the recording medium.

3. The apparatus as claimed in claim 1, wherein the recording medium is a DVD-RAM disc or a land/groove type next generation DVD-RAM disc.

4. A method of detecting defocus and/or a change in thickness of a recording medium, the method comprising:

dividing light reflected/diffracted by the recording medium into first, second and third light regions in a direction corresponding to a radial direction of the recording medium;

generating first, second and third detection signals corresponding to light intensity in the first, second and third light regions, respectively; and

subtracting a sum of the first and third detection signals and the second detection signal.

5. The method as claimed in claim 4, wherein the recording medium is a DVD-RAM disc or a land/groove type next generation DVD-RAM disc.

6. A seek direction detecting apparatus comprising:

a photodetector having first, second, third and fourth light receiving regions arranged in a direction corresponding to a radial direction of a recording medium to independently perform photoelectric conversion with respect to incident light reflected/diffracted by the recording medium and to output first, second, third and fourth detection signals,

respectively;

a signal processor comprising:

a first subtractor which subtracts a sum of the first and fourth detection signals and a sum of the second and third detection signals, to generate a first error signal,

a second subtractor which subtracts a sum of the first and second detection signals and a sum of the third and fourth detection signals to generate a second error signal, and

a comparator which compares the first error signal and the second error signal to generate a seek direction detection signal.

7. The apparatus as claimed in claim 6, wherein:

the first through fourth light receiving regions of the photodetector are each divided in a direction corresponding to a tangential direction of the recording medium to form eight light receiving regions; and

the eight light receiving regions are used to detect information signals recorded on the recording medium.

8. The apparatus as claimed in claim 6, wherein the recording medium is a DVD-RAM disc or a land/groove type next generation DVD-RAM disc.

9. A method of detecting a seek direction on a recording medium, the method comprising:

irradiating light including a predetermined amount of defocus on the recording medium;

dividing the light reflected/diffracted by the recording medium into first, second, third and fourth light regions corresponding to a radial direction of the recording medium;

generating first, second, third and fourth detection signals corresponding to the first, second, third and fourth light regions, respectively;

subtracting a sum of the first and fourth detection signals and a sum of the second and third detection signals, to generate a first error signal;

subtracting a sum of the first and second detection signals and a sum of the third and fourth detection signals, to generate a second error signal; and

comparing the first error signal and the second error signal, to generate the seek direction error signal.

10. The method as claimed in claim 9, wherein the recording medium is a DVD-RAM disc or a land/groove type next generation DVD-RAM disc.

11. A method of generating error signals for controlling optical recording/reproduction from an optical disc, the method comprising:

generating first, second and third detection signals, the first and second detection signals corresponding respectively to light reflected from radially inward and radially outward portions of a light spot formed on the optical disc, and the third detection signal corresponding to light reflected/refracted from a central portion of the light spot; and

subtracting a sum of the first and second detection signals and the third detection signal to output the error signal.

12. A method of generating error signals for controlling optical recording/reproduction from an optical disc, the method comprising:

generating first, second, third and fourth detection signals, the first and second detection signals corresponding respectively to light reflected/refracted from radially inward and radially outward portions of a light spot formed on the optical disc, and the third and fourth detection signals corresponding to light reflected/refracted from first and second central portions of the light spot; and

subtracting a sum of the first and second detection signals and a sum of the third and fourth detection signals to generate a defocus error signal.

13. The method of claim 12, further comprising:

subtracting a sum of the first and third detection signals and a sum of the second and fourth detection signals to generate a push-pull tracking error signal.

14. The method of claim 13, further comprising:

comparing the defocus error signal and the push-pull tracking error signal to generate a seek direction error signal.

15. The method of claim 14, wherein the comparing comprises:

binarizing the defocus error signal with respect to a predetermined DC value;  
binarizing the push-pull tracking error signal; and  
comparing the binarized defocus error signal and the binarized push-pull tracking error signal to generate the seek direction error signal.

16. The method of claim 14 further comprising:

AC coupling the defocus error signal prior to the binarizing of the defocus error signal.

17. A method of determining whether a light spot is formed on a land or a groove of an optical disc, the method comprising:

- defocusing the light spot by a predetermined amount;
- generating first, second, third and fourth detection signals, the first and second detection signals corresponding respectively to light reflected/refracted from radially inward and radially outward portions of the light spot formed on the optical disc, and the third and fourth detection signals corresponding to light reflected/refracted from first and second central portions of the light spot;
- subtracting a sum of the first and second detection signals and a sum of the third and fourth detection signals to output a subtraction result;
- determining that the light spot is formed on a land of the optical disc if the subtraction result is greater than a predetermined value; and
- determining that the light spot is formed on a groove of the optical disc if the subtraction result is less than a predetermined value.

18. A method of generating error signals for controlling optical recording/reproduction from an optical disc, the method comprising:

- generating first, second, third and fourth detection signals, the first and second detection signals corresponding respectively to light reflected/refracted from radially inward and radially outward portions of a light spot formed on the optical disc, and the third and fourth detection signals corresponding to light reflected/refracted from first and second central portions of the light spot; and
- subtracting a sum of the first and third detection signals and a sum of the second and fourth detection signals to generate a push-pull tracking error signal.

19. An apparatus for detecting error signals for recording to or reproducing from an optical recording medium, the apparatus comprising:

- a photodetector which generates a plurality of detection signals, wherein the first and second of said plurality of detection signals correspond to light reflected/refracted from radially and radially outward portions, respectively, of a light spot formed on the recording medium and another of said plurality of detection signals corresponds to light reflected/refracted from a central portion of the light spot; and
- a subtractor which subtracts a sum of the first and second detection signals and the another detection signal to output a first error signal.

20. The apparatus of claim 19, wherein:

the another detection signal comprises a sum of third and fourth detection signals corresponding to light reflected/refracted from radially inward and radially outward portions, respectively, of the central portion of the light spot.

21. The apparatus of claim 20, further comprising:  
a second subtractor which subtracts a sum of the first and third detection signals and a sum of the second and fourth detection signals to generate a second error signal.

22. The apparatus of claim 21, further comprising:  
a comparator which compares the first and second error signals to generate a seek direction error signal.

23. The apparatus of claim 19, wherein the optical recording medium comprises a DVD-RAM disc having a track pitch of about  $0.615\text{ }\mu\text{m}$ .

24. The apparatus of claim 19, wherein the optical recording medium comprises a DVD-RAM disc having a track pitch of about  $0.34\text{ }\mu\text{m}$ .

25. The apparatus of claim 19, wherein the optical recording medium comprises a land/groove structure having a track pitch of not more than  $0.3\text{ }\mu\text{m}$ .

26. The apparatus of claim 25, wherein where the light spot is formed on a land, a slope of a plot of the first error signal according to an amount of defocus is positive.

27. The apparatus of claim 25, wherein where the light spot is formed on a groove, a slope of a plot of the defocus error signal according to an amount of defocus is negative.

28. The apparatus of claim 25, wherein where the light spot is formed on a land, a slope of a plot of the first error signal according to recording medium thickness is negative

29. The apparatus of claim 25, wherein where the light spot is formed on a land, a slope of a plot of the first error signal according to recording medium thickness is positive.